STUDIES ON THE PHYSIOLOGY OF REPRODUCTION IN THE DOMESTIC FOWL. XII.

On an Abnormality of the Oviduct and Its Effect upon Reproduction.[1]

MAYNIE R. CURTIS.

In a recent paper Pearl and Curtis (1914) have shown that when the passage of an egg through the oviduct is prevented by surgical interference with the duct the sex organs pass through their normal reproductive cycles. The oviduct functions to the level where the passage is interrupted and the egg is then returned into the body cavity. The eggs thus set free may be absorbed without causing any serious disturbance in metabolism. In a paper still in press (Curtis and Pearl) it has also been shown that congenital or acquired obstructions to the oviduct may occur without artificial interference and that the results in such cases are the same as in the former cases.

The following case was recently brought to our attention by Mr. J. C. Hawkes, Poultryman at the Maine Agricultural College poultry plant.

A year and a half old Rhode Island Red bird was killed for meat. She was well grown, in good flesh and in every respect was perfectly normal in appearance. When an incision was made to remove the viscera a full sized membrane shelled egg slipped into the opening. Mr. Hawkes then kindly turned the bird over to us for examination.

The eggs and egg membranes shown in Fig. 1 were all removed from the body cavity of this bird. These represented every possible stage of absorption of the egg from a normal membrane shelled fresh egg to the collapsed empty membranes shown in the fourth line of the figure. Some of the eggs and some of the empty membranes were free in the body cavity. Some were

[1] Papers from the Biological Laboratory of the Maine Agricultural Experiment Station No. 76.

partly or entirely enclosed by peritoneum. In several instances two eggs or an egg and a bunch of membranes were walled off together. The last line of the figure shows collections of empty membranes enclosed in peritoneum. These peritoneal covered masses were attached by suspending strings or folds of peritoneum. The large mass at the right end of this line contains a very large number of these empty membranes. A larger view of it is shown in Fig. 2. The second line from the bottom of Fig. 1 shows collapsed empty egg membranes of which some are single and some two or three tightly packed together. The three top lines of the figure show eggs in various stages of resorption. One was a normal fresh egg in a single egg membrane. Ten had evidently been normal eggs but at the time of autopsy they contained a homogeneous mixture of yolk and albumen which had lost the gelatinous character of fresh egg albumen. Each of these eggs was enclosed in a single egg membrane. The other four eggs were double eggs. These eggs were much like the double eggs (*ovum in ovo*) described by Parker (1906), Patterson (1911) and by many other writers. (The appended bibliography is supplementary to the one given by Parker 1906.)

The eggs of this sort described in the literature had all been laid. Most of them have had shell on one or both of the concentric components. The double eggs found in the body cavity of this Rhode Island Red hen had no shell on either the enclosed or enclosing egg. The nature of the contents of the double eggs differed in each of the four cases. In one both enclosed and enclosing egg contained yolk. The yolk and albumen of the enclosing egg were somewhat mixed, although they did not yet constitute a homogeneous fluid. In fact the currents or streams of yolk could be seen in the clear albumen through the semitransparent egg membrane. The yolk and albumen of the enclosed egg were still more distinct although the yolk membrane had already ruptured. The enclosed egg was about the size of the normal egg and the enclosing egg (the third egg in the top line) was the largest egg found in the body cavity. A second double egg was composed of a normal sized enclosed egg which had apparently contained the normal egg parts. The contents had, however, been reduced to a homogeneous brownish-yellow liquid

much thinner than fresh egg albumen. The enclosing egg was only slightly larger than the egg it enclosed and it seemed probable that a second egg membrane had been received directly around the first on its passage back up the duct. A third of the double eggs had two closely applied egg membranes as in the preceding case but the enclosed egg was itself a double egg. The inner egg in this series was a small "witch" or "cock" egg containing a little yolk not enclosed in yolk membrane and a small amount of normal fresh albumen. The outer egg contained only normal fresh albumen. The other double egg was even more remarkable in character as it consisted of a concentric series of four enclosed eggs. The inner one, like the inner egg just described, contained a little free yolk enclosed in normal albumen. Each of the successive enclosing eggs contained only normal albumen. This whole egg was not larger than a normal hen's egg.

These peculiar double formations indicate that an egg did not always pass up the duct in time to get out of the way of a succeeding egg. In case an egg met another yolk it might become enclosed in a double egg or it might change the direction of the incoming yolk If the yolk was ruptured and a part remained in the duct it might furnish the nucleus for a "cock" egg which might then become enclosed in a succeeding egg. Apparently the direction of peristaltic movements became at times much disturbed, as the last double egg described must have passed up and down the duct several times before it was finally extruded into the body cavity.

The visceral organs of the bird were in normal condition. There was a little slightly oily yellowish serous fluid bathing the viscera. The peritoneum was very slightly thickened but otherwise normal. The ovary was normal with a normal series of enlarging yolks and resorbing follicles. It was apparent that the bird was in the midst of a normal reproductive period and was backing membrane shelled eggs into the body cavity and resorbing them with great rapidity.

The oviduct (Fig. 3) was perfectly normal from the funnel mouth to the posterior end of the isthmus. Here the tube abruptly ended blindly at *D*. There was no shell gland or vagina.

The oviduct ligaments were continuous to the posterior end of the body cavity. That is the tube ended in the fold of enclosing peritoneum while the fold continued to the posterior end of the body cavity. The heavy bands of smooth muscle in the ventral ligament (see *E*, Fig. 3) continued to the end of the body cavity —several centimeters beyond the end of the tube. The tube rounded off smoothly at the posterior end and the ligament behind did not present the slightest indication that it had ever contained any oviduct tissue. It seems probable that the duct had never extended any farther than at present. From the embryonic history of the oviduct it is evident that if the actively growing point of a duct should cease at an unusually long distance anterior to the cloaca a blind oviduct of this form might result.

The development of the oviduct according to the account given by Lillie (1908) begins on the fourth day of incubation as a groove-like invagination of a strip of thickened peritoneum on the surface of the Wolffian body or embryonic kidney. The lips of this groove fuse on the fifth day so as to form a short tube open anteriorly to the body cavity and ending blindly posteriorly. The open end of this tube becomes the *ostium tubæ abdominale* or funnel mouth of the oviduct. The posterior end grows backward between the strip of thickened peritoneum and the Wolffian body. It normally reaches the cloaca on the seventh day. The growing point is always a short solid wedge of cells. The duct receives its lumen a short distance anterior to this. On the twelfth day of incubation the primordium of the shell gland is distinctly visible as an expansion of the lower end of this tube.

The most probable explanation of the abnormality of the oviduct found in the case described is that in early embryonic development (probably on the sixth or seventh day of incubation) the backward growth of the primordial oviduct stopped permanently while the differentiation of the part already formed continued in the normal manner.

As in other cases where the passage of the egg is prevented the sex organs passed through their normal reproductive cycles; the oviduct functioned as far as the point where the passage was interrupted; the eggs were then returned to the body cavity and resorbed. The number of eggs and empty egg membranes found

in this fowl which was apparently in a perfectly normal physical condition show that a bird possesses very great power of resorption of its own proteins from the peritoneal cavity. Such resorption does not necessarily cause metabolic disturbances.

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Explanation of Plate I.

Fig. 1. Eggs and egg membranes removed from the body cavity of a Rhode Island Red fowl.

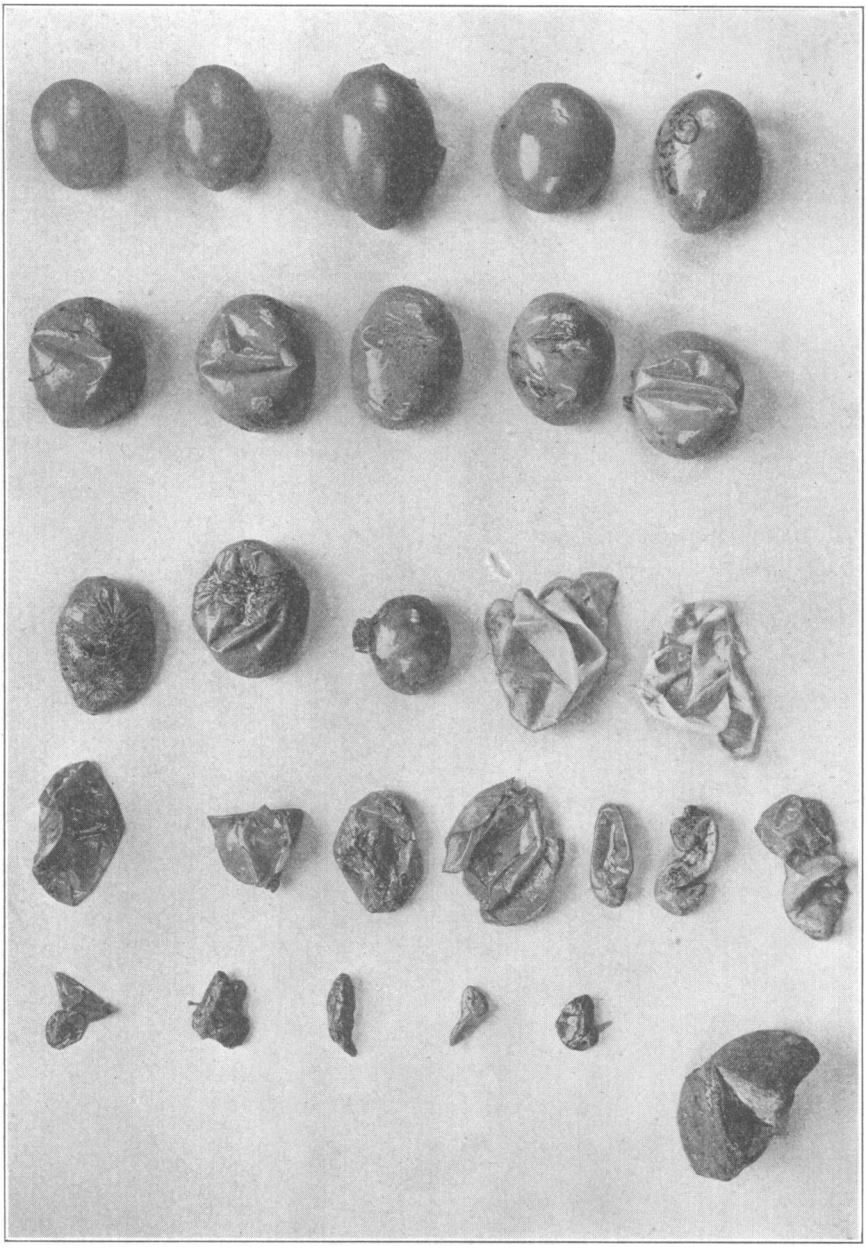

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FIG. I.

Explanation of Plate II.

Fig. 2. Natural size photograph of the large peritoneal covered mass of egg membranes shown at the lower right hand corner of Fig. 1. This is cut across and opened back to show its composition.

Fig. 3. Photograph (greatly reduced) showing the oviduct of the bird from which the eggs in Fig. 1 were taken. A =funnel; B =albumen secreting region; X =isthmus ring; C =isthmus; D =blind end of the oviduct; E =mass of smooth muscle in ventral ligament posterior to the end of the oviduct.

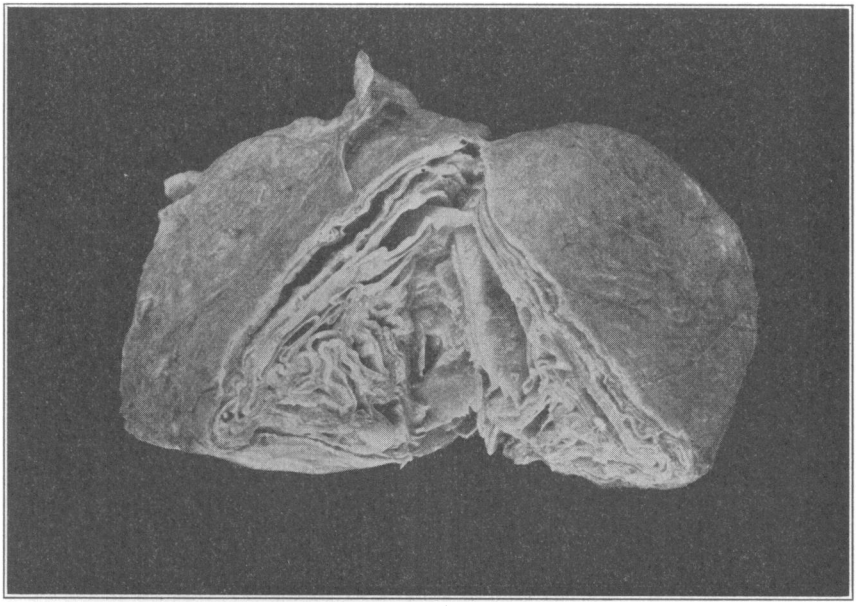
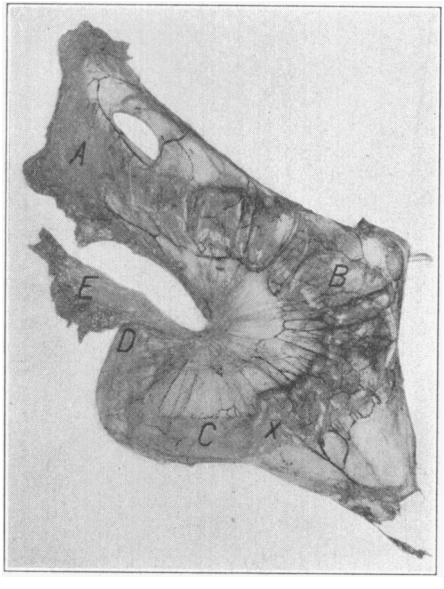


FIG. 2.



MAYNIE R. CURTIS. FIG. 3.